Final Technical Report - NASA grant NSG-7290 (Started 10/1/76)

This grant went through several phases. The initial work dealt with the effects of light perceived by phytochrome on gravitropic behavior in etiolated peas. Pfr was shown to increase graviperception without altering the rate-limiting steps underlying the generation of curvature. Later, it was shown that gravitropism and nutational movements are dissociable by such treatments as red-light irradiation, removal of the apical bud and treatment with inhibitors of auxin transport. Gravitropic curvature is thus dependent on processes distinct from the mechanisms that generate nutations, contrary to the prevalent theory at that time. In parallel studies, it was shown that totally dark-grown pea seedlings do not curve phototropically in response to blue light, but will do so if preirradiated with red light a few hours before the blue light stimulus is administered.

A second phase of the work dealt with the nature of amyloplasts, the presumed receptors of the gravitropic stimulus. Such amyloplasts were isolated in bulk from bundle sheath cells of etiolated pea epicotyls, and studies were made of their fine structure, physical characteristics and properties of a surface-layer magnesium sensitive ATPase. Fine structure studies were also made of mung bean and oat seedlings returned from space flight.

The final phase of the work dealt with the relation between gravitropism and the movement of calcium across responding pea epicotyls. Although work in other laboratories had suggested that calcium moves in directions opposite to IAA during early stages of gravitropic response in roots and that such movement is essential to response, our work showed that calcium is almost exclusively in the apoplast, that its asymmetry arises as a secondary consequence of IAA movement and that its movement is dissociable from IAA movement. Ten published papers, previously reported to the technical monitor, have resulted from this work, and at least one more is in preparation.

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